

## Scientific Report for COST-STSM-P18-02142

In the frame of the STSM, I spent six days in the Danish National Space Center (DNSC) in Copenhagen, Denmark from 21<sup>st</sup> August to 27<sup>th</sup> August, 2006. Primarily objectives of my visit were:

- Participation in scientific and programmatic discussion of the meeting of the research training network "Coupling of Atmospheric Layers" (CAL) (24-25 August, 2006.)
- Discussion of implementation and publication of results from the Extremely Low Frequency (ELF) field measurements at Nagycenk (NCK), Hungary during the Euro-Sprite 2005 observation campaign.
- Discussion of preliminary results from the ELF field measurements at Nagycenk, Hungary in the ongoing Euro-Sprite 2006 observation campaign.
- Becoming acquainted with the instrumentation of the observation campaigns and getting skills of operation by some practice.
- Discussion of possibilities of future observations of lightning and related upper atmospheric optical phenomena above the Carpathian basin.

Various techniques of optical observation of transient luminous events (TLEs, e.g. sprites and elves) occurring in the upper atmosphere were discussed with researchers and technicians of the DNSC. Basic technical requirements of optical TLE observations have been reviewed then the development of remote-controlled observation systems was considered. All parts of such systems were thoroughly discussed: parameters of the camera (sensitivity, viewing angle, frame rate), camera aiming (manual [local] or motorized [remote], direction finding), video digitizing and recording solutions, softwares for image processing, remote setting of cameras and triggered recording, triggering thresholds. Special attention was paid to the problem of assigning millisecond accuracy time stamps to the observed video frames by on site GPS antenna (video overlay or other software solutions).

Experiences were exchanged on controlling the currently operating system on Pic du Midi (France). Remote ELF records from NCK, Hungary were compared with lightning data from the last year's observation campaign and the event detection efficiency of both systems was investigated.

I attended the CAL meeting and I presented the latest results deduced from remote ELF field measurements at NCK, Hungary. Charge moment change was calculated for most of those discharges that were associated with observed TLE in the Euro-Sprite 2005 observation campaign. Calculated values will be included in the data set of all measured parameters in association of TLEs observed during the campaign. Directions of further analysis of the recorded ELF field data have been suggested and discussed. I learned from the presentations of the meeting how the data from more types of observations as well as modeling can be combined to disclose characteristics of complex phenomena such as TLEs. More aspects of choosing the right place for optical TLE observations have been turned up during conversations with other participants. These include the height of the observation site and general meteorological conditions at the planned location (wind patterns and cloud formation).

The CAL community agreed in that the optical observations of TLEs should continue and the observed area should be widened since more details are still unknown regarding especially the initiation conditions of the TLEs and mainly sprites. For this reason compact, standalone and remotely controllable observation systems (developed in the DNSC) would be deployed at more places, also in Europe. These serve as testing boards for the equipment to be placed on the Atmosphere-Space Interactions Monitor (ASIM) satellite, scheduled to be launched in 2011 by ESA. The number of the systems depends on the amount of available financial support. Some of these observation sites would be operated in collaboration between the GGRI and the DNSC. The GGRI will contribute to the ASIM observations and to the preceding ground campaigns with remote ELF field measurements.

Recording of ELF data is continuous at NCK. Utilization of our records has been discussed in connection with the currently running Euro-Sprite 2006 observation campaign.

Charge moment values deduced from ELF data will be included in papers describing the observations and results of the Euro-Sprite 2005 observation campaigns.

I would like to emphasize that I found my visit very useful and promotional. I believe that the scientific objectives of the mission have been fulfilled. I learned a lot about conducting optical TLE observations and I could meet some very illustrious researchers as well as other students like myself. Thank you for your support.



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József Bór

1. September, 2006.